

Mercury in Virginia's Waters

Jon A. Mueller



CHESAPEAKE BAY FOUNDATION

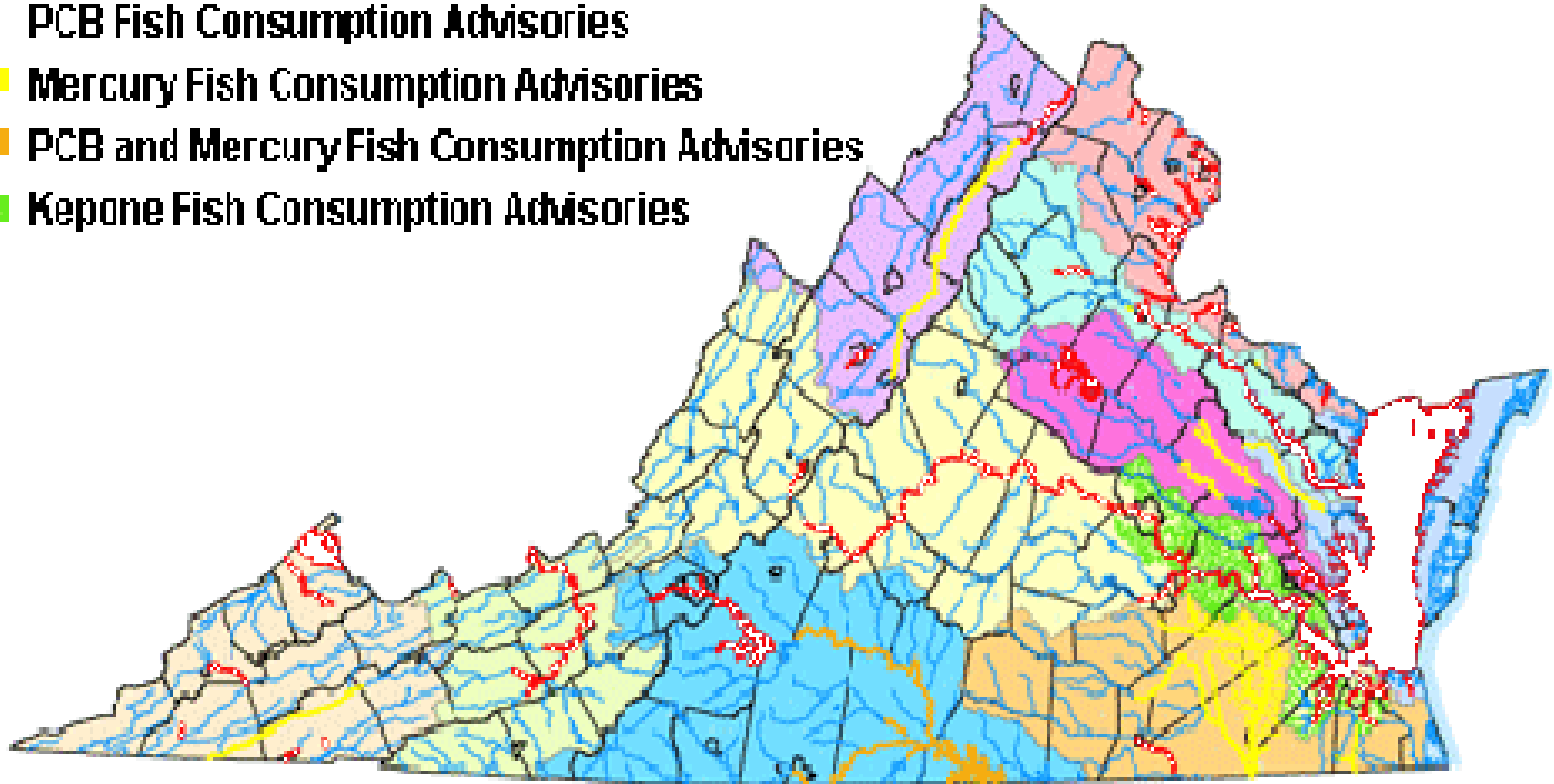
Saving a National Treasure

PCB Fish Consumption Advisories

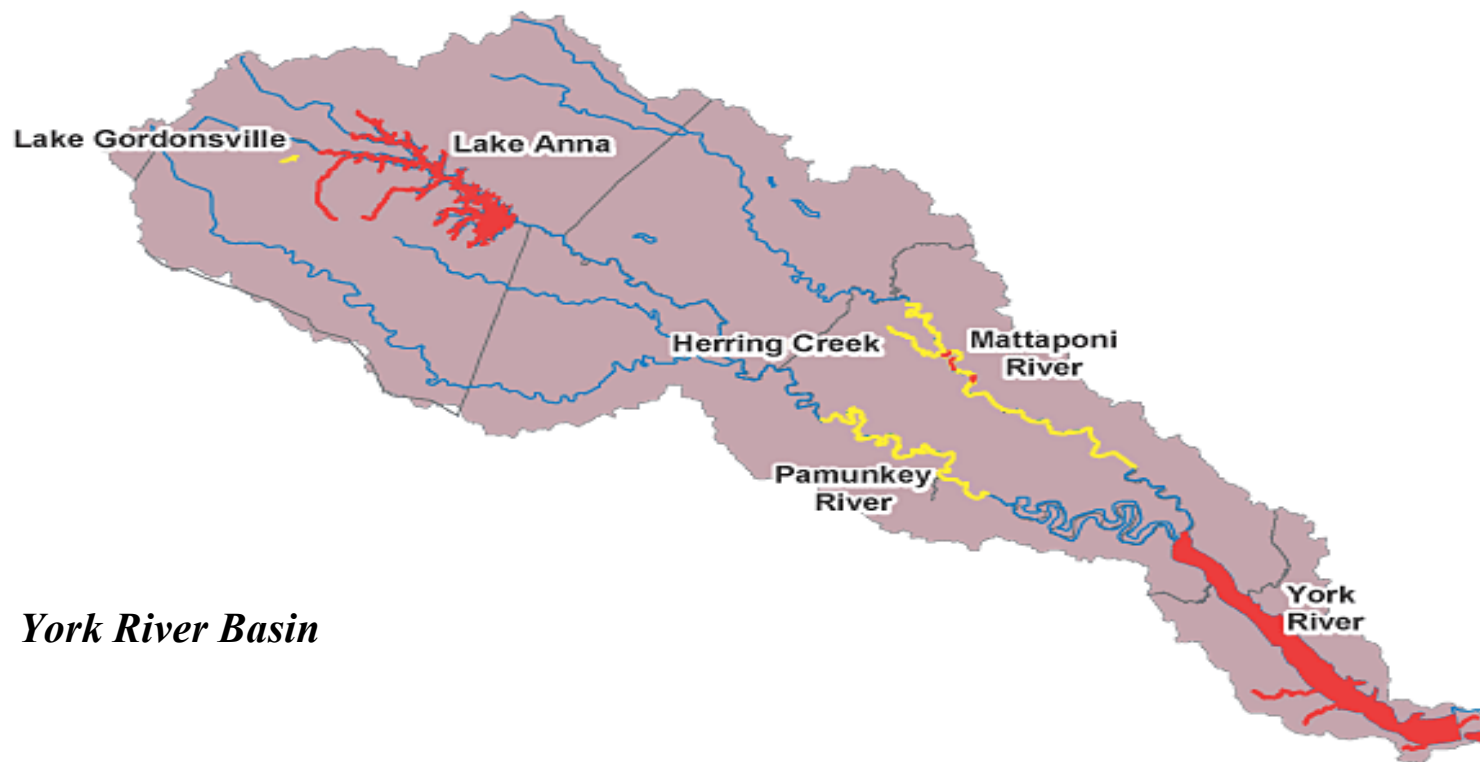
Mercury Fish Consumption Advisories

PCB and Mercury Fish Consumption Advisories

Kepona Fish Consumption Advisories



- PCB Fish Consumption Advisories
- Mercury Fish Consumption Advisories



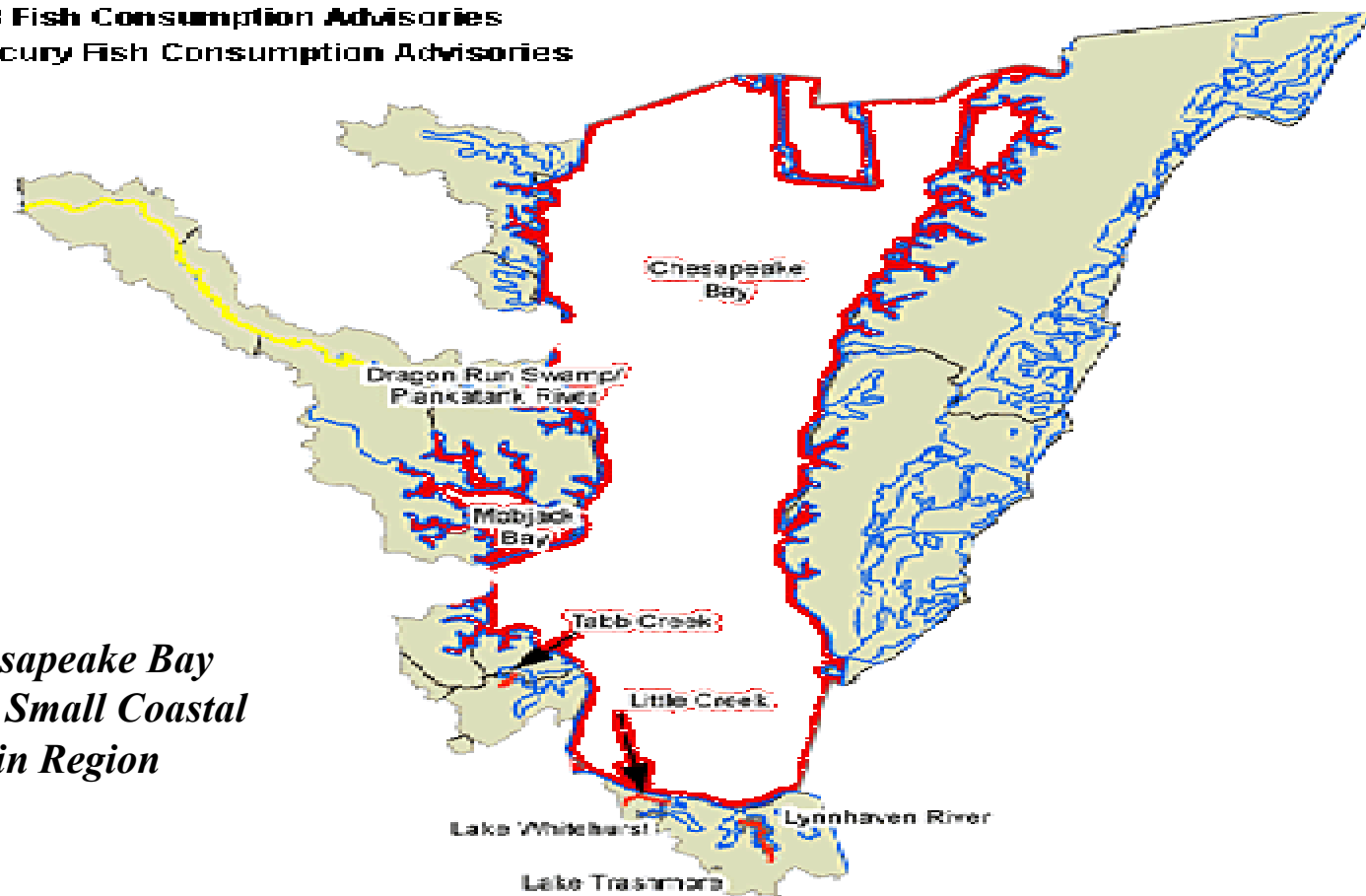
York River Basin

Bodies of water with fish consumption advisory due to Mercury:

- Lake Gordonsville
- Pamunkey River
- Mattaponi River
- Herring Creek

- PCB Fish Consumption Advisories
- Mercury Fish Consumption Advisories

*Chesapeake Bay
and Small Coastal
Basin Region*



Bodies of water with fish consumption advisory due to Mercury:

- Lake Trashmore
- Lake Whitehurst
- Dragon Run Swamp
- Piankatank River

Chowan and Dismal Swamp River Basin

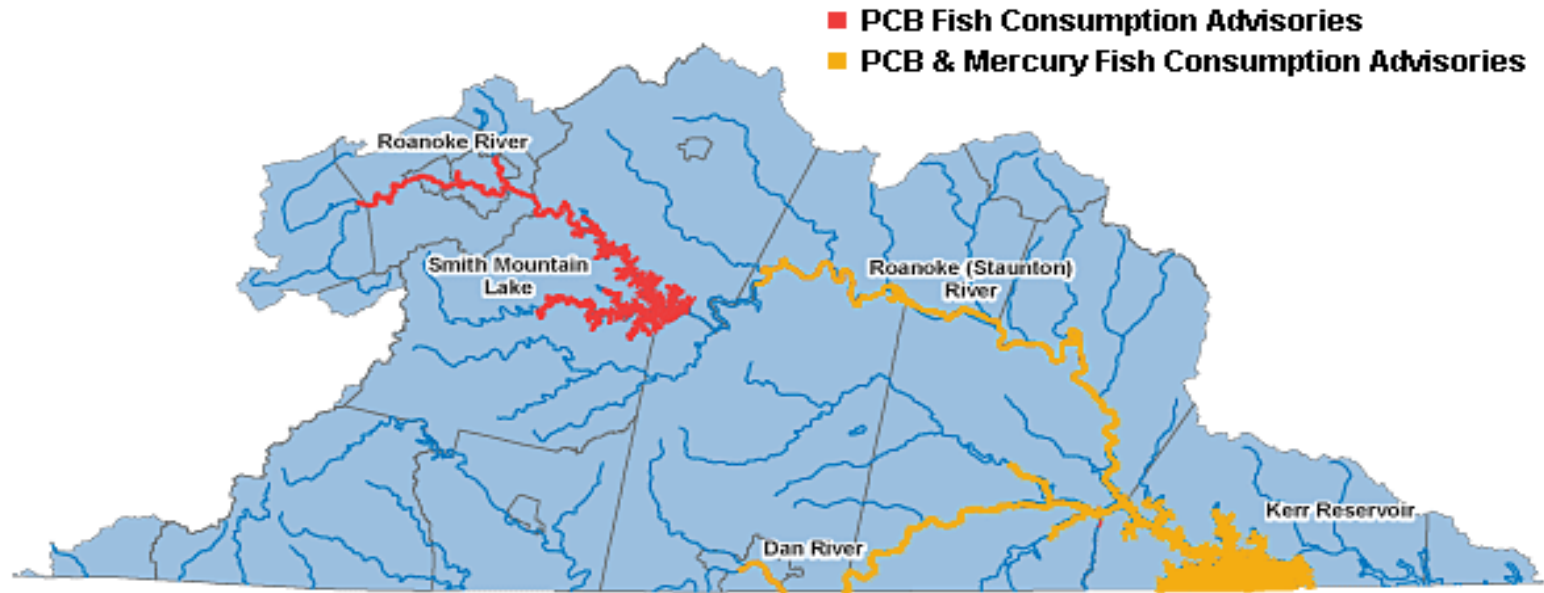
- PCB Fish Consumption Advisories
- Mercury Fish Consumption Advisories



Bodies of water with fish consumption advisory due to Mercury:

- Blackwater River
- Assamoosick Swamp
- Nottoway River
- Great Dismal Swamp, Lake Drummond

Roanoke River Basin



Bodies of water with fish consumption advisory due to Mercury contamination:

- Dan River
- Staunton River
- Kerr Reservoir

Final Report for
CHESAPEAKE BAY ANGLER INTERVIEWS
IDENTIFYING POPULATIONS AT RISK FOR CONSUMING
CONTAMINATED FISH IN THREE REGIONS OF CONCERN

CMI-HDD-05-01

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Prepared for the
Chesapeake Bay Program

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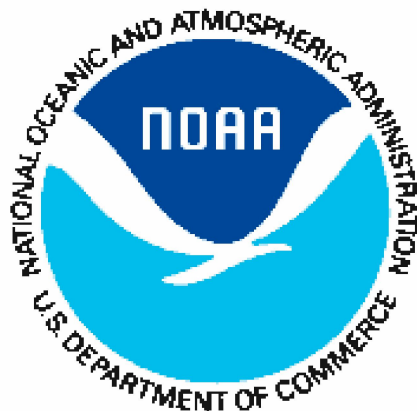
- 1 Fletcher's Boat House
- 2 Theodore Roosevelt Island
- 3 Lady Bird Johnson Park/Columbia Island Marina
- 4 Gravelly Point/Roaches Run
- 5 East Potomac Park/Haines Point
- 6 Monument Tidal Basin
- 7 Water Street Marina Area
- 8 Dangerfield Island/Washington Sailing Marina
- 9 Anacostia Park South



- 1 Denbigh Park
- 2 Huntington Park Boat Ramp
- 3 James River Bridge Fishing Pier
- 4 Peterson Yacht Basin/Anderson Park
- 5 Jones Creek Boat Ramp
- 6 Haven Creek Boat Ramp/Lafayette City Park
- 7 Elizabeth City Boat Landing and Park
- 8 Portsmouth City Park
- 9 Great Bridge Lock Park



Modeling the Fate and Transport of Atmospheric Mercury in the Chesapeake Bay Region



**Dr. Mark Cohen
NOAA Air Resources Laboratory
Silver Spring, Maryland**



**Presentation at
NOAA Chesapeake Bay Office
May 17, 2004, Annapolis MD**

Three “forms” of atmospheric mercury



Elemental Mercury: Hg(0)

- ~ 95% of total Hg in atmosphere
- *not* very water soluble
- long atmospheric lifetime (~ 0.5 - 1 yr); globally distributed



Reactive Gaseous Mercury (“RGM”)

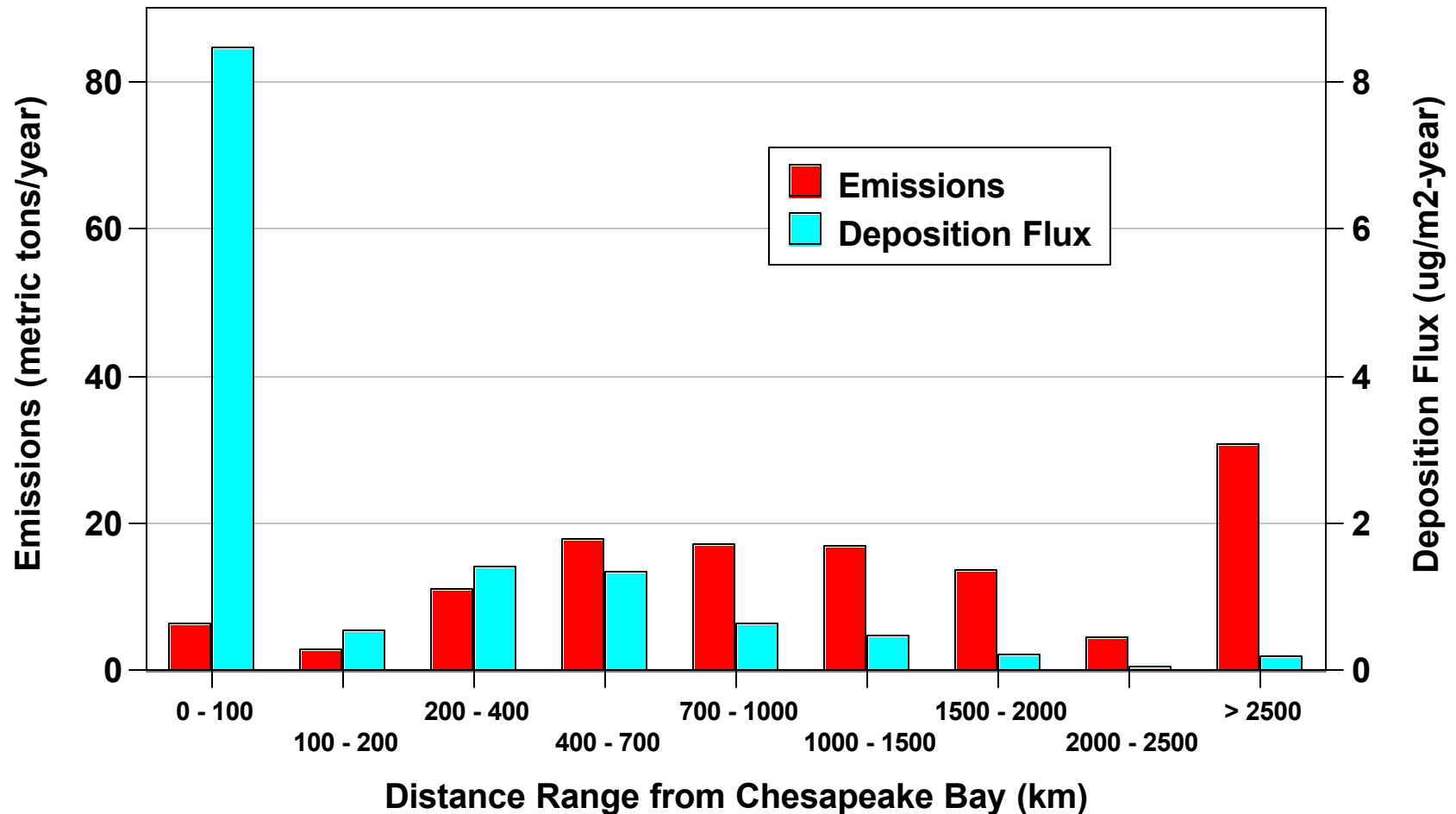
- a few percent of total Hg in atmosphere
- oxidized mercury: Hg(II)
- HgCl₂, others species?
- somewhat operationally defined by measurement method
- *very* water soluble
- short atmospheric lifetime (~ 1 week or less);
- more local and regional effects



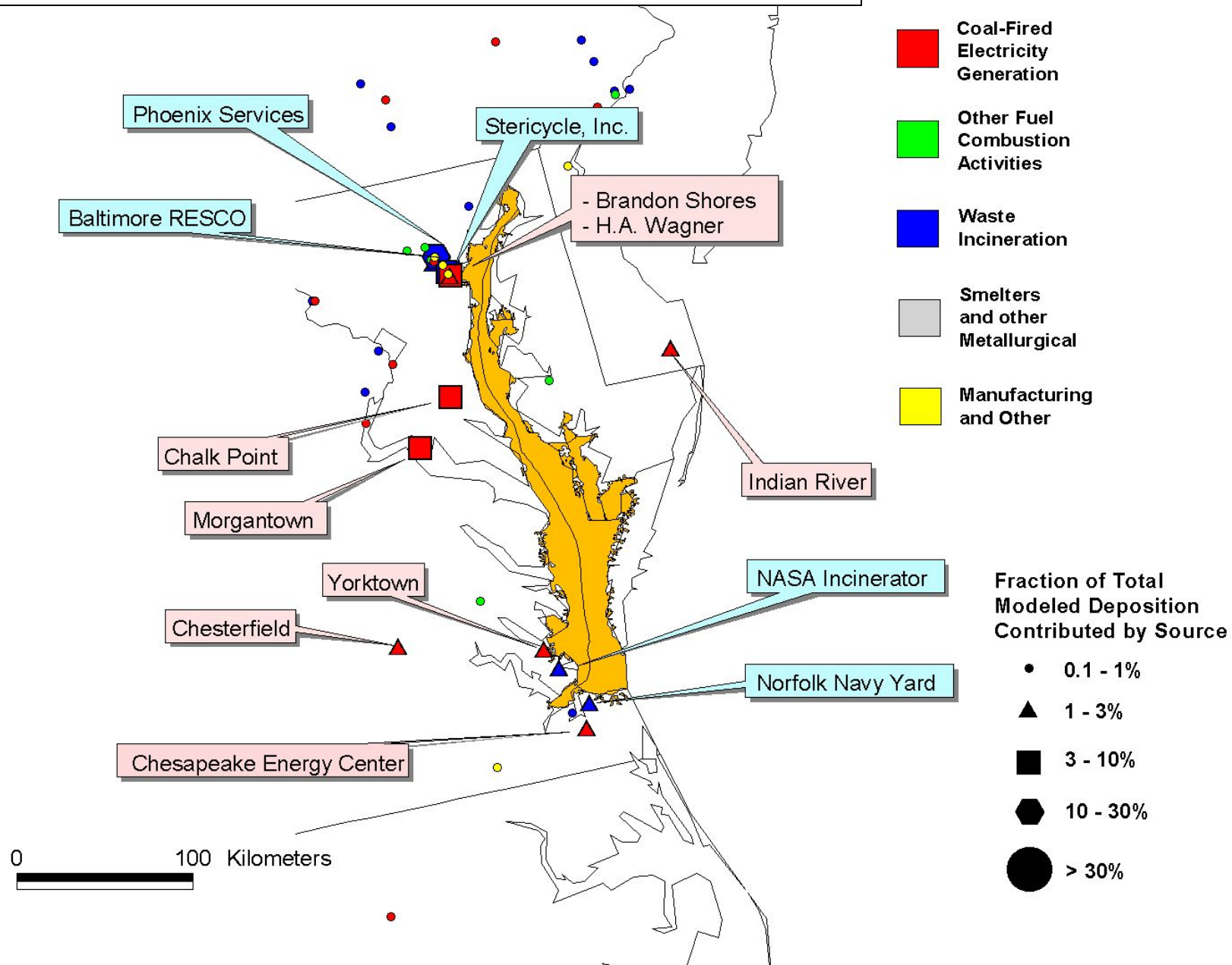
Particulate Mercury (Hg(p))

- a few percent of total Hg in atmosphere
- not pure particles of mercury...
(Hg compounds associated with atmospheric particulate)
- species largely unknown (in some cases, may be HgO?)
- moderate atmospheric lifetime (perhaps 1~ 2 weeks)
- local and regional effects
- bioavailability?

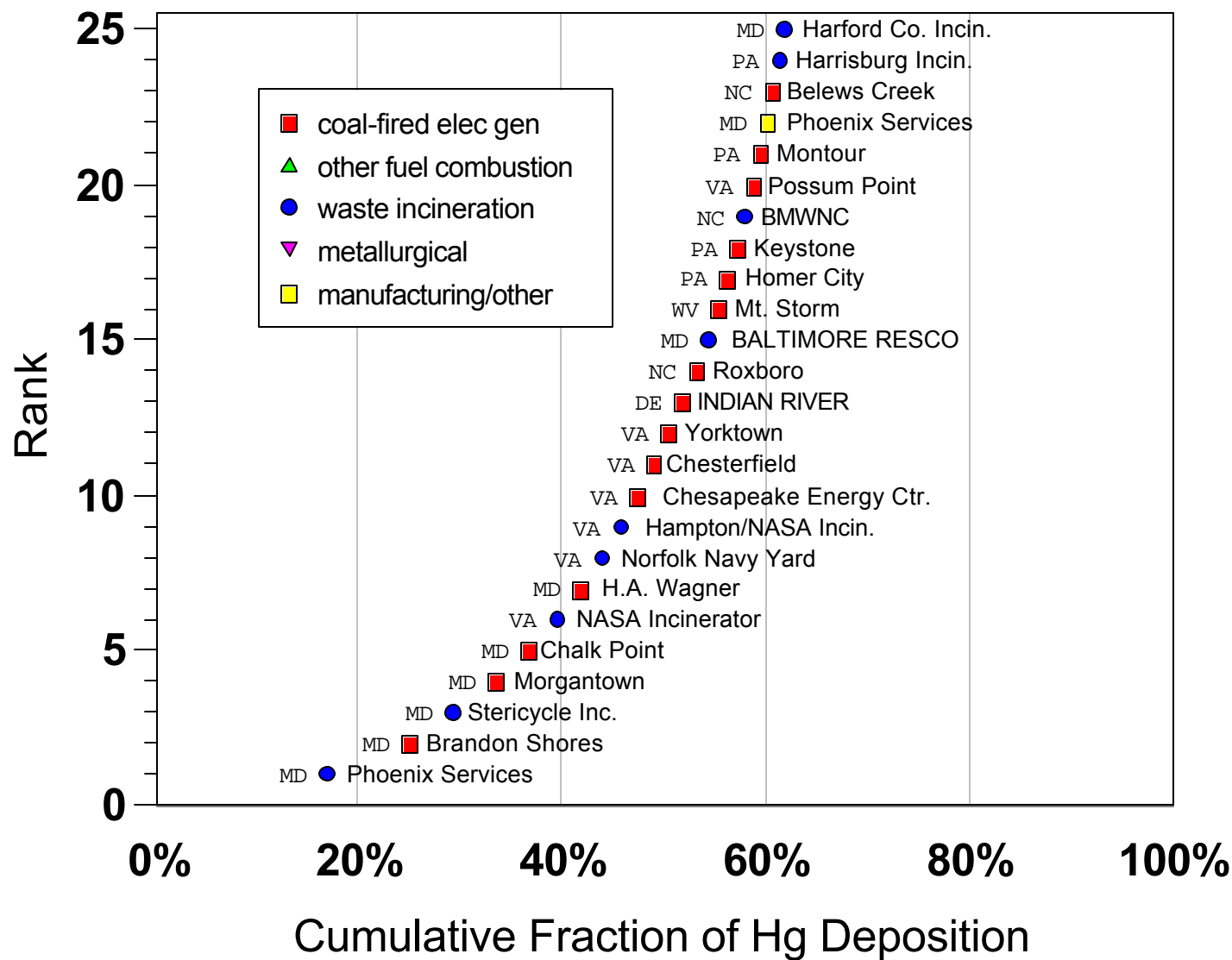
Emissions and Direct Deposition Contributions from Different Distance Ranges Away From the Chesapeake Bay



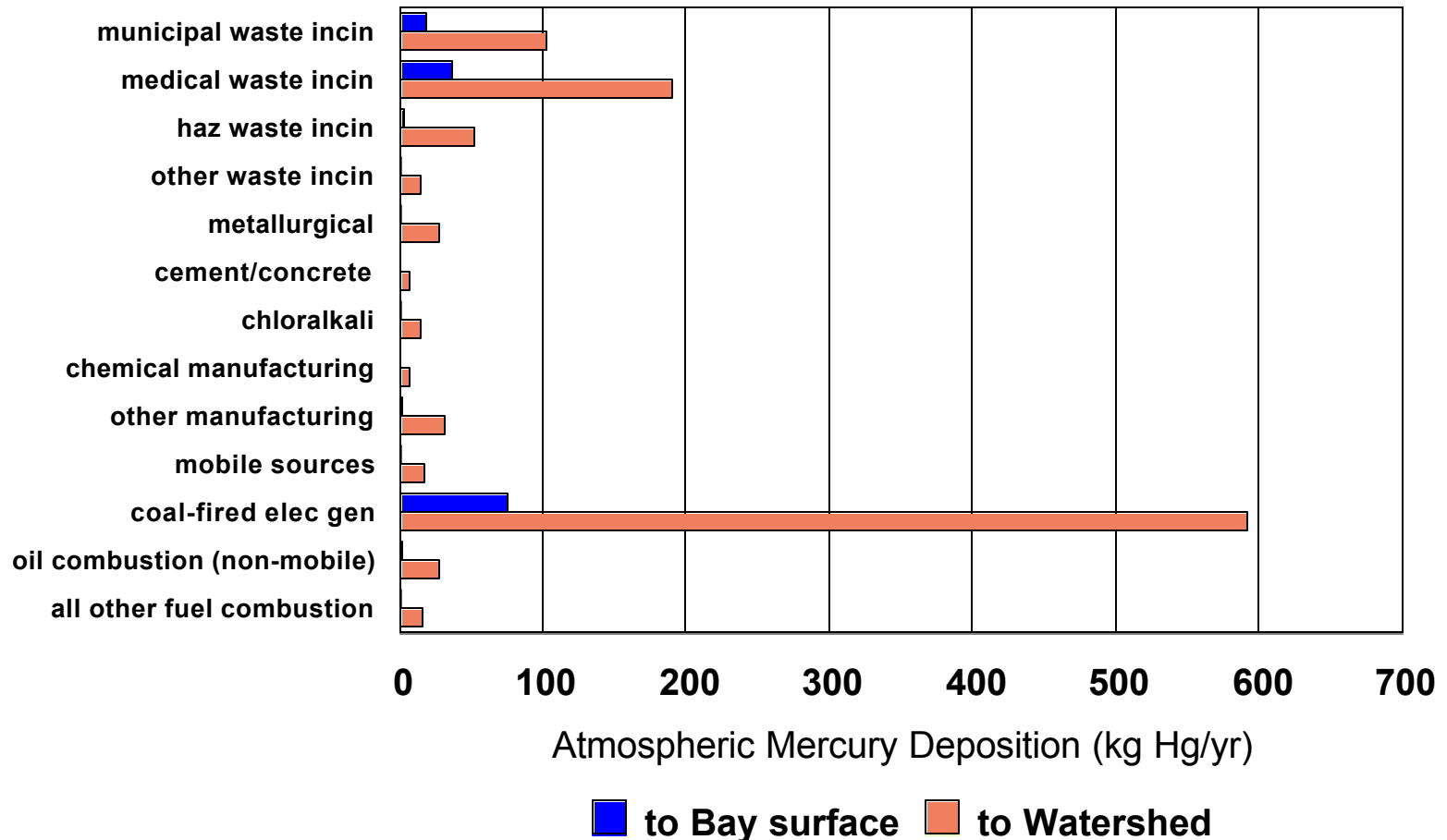
Largest Local Individual Sources Contributing to 1999 Mercury Deposition Directly to the Chesapeake Bay



Top 25 Contributors to 1999 Hg Deposition Directly to the Chesapeake Bay



Deposition to the Chesapeake Bay and to its Watershed (~1999) (linear graph)



Sources Modeled

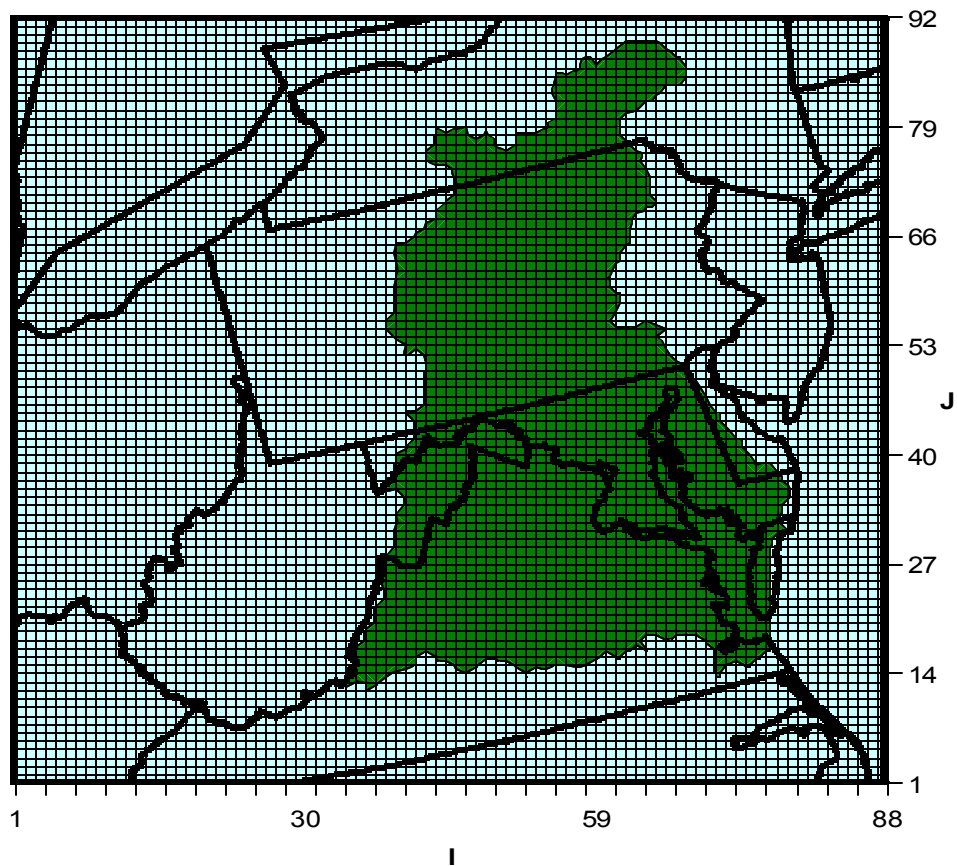


Table 1. Modeled Mercury Emission Sources

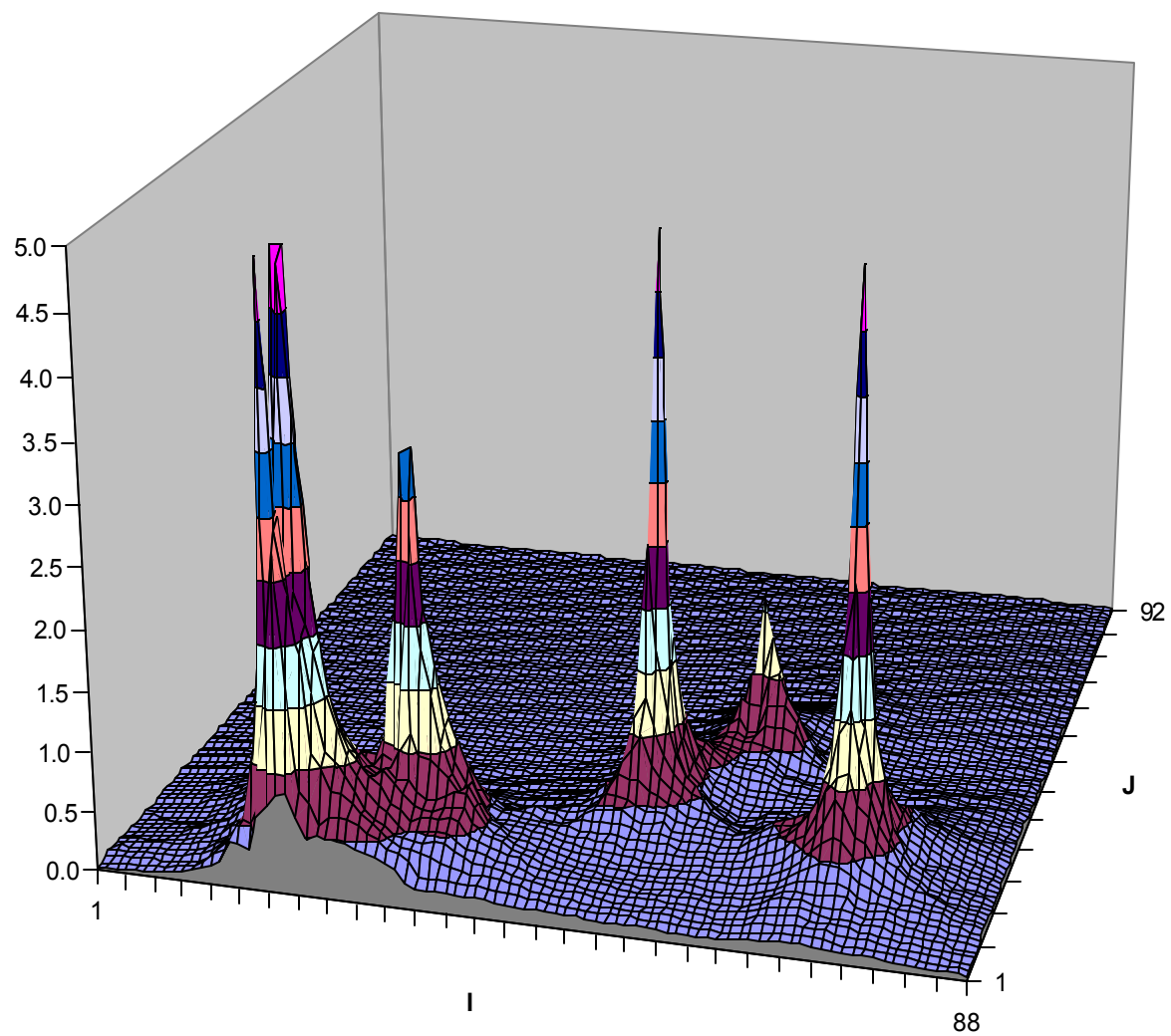
Source	Lat (N)	Lon (W)	Base Elev(m)	No. of stacks	Mercury Emissions, 1999 (lb/yr)			
					Hg(total)	Hg(0)	RGM	Hg (p)
Bremo Bluff	37.708	78.288	70.1	2	127.0	47.4	73.6	6.2
Chesapeake	36.771	76.302	3.0	3	182.9	47.2	124.8	11.2
Clinch River	36.933	82.198	445.0	2	157.0	40.4	107.2	9.6
Glen Lyn	37.370	80.864	469.4	2	87.1	22.4	59.4	5.4
Jewell Coke	37.234	82.037	353.6	2	337.0	269.6	33.8	33.8
Potomac River	38.820	77.041	9.1	3	83.5	21.4	57.0	5.0
All Pt Sources in Virginia					2,924			

Bay Watershed on Grid Scale

Chesapeake Bay Watershed



Hg Deposition (g/km²-yr): All Six VA Sources



Hg Deposition (g/km²-yr): All Six VA Sources

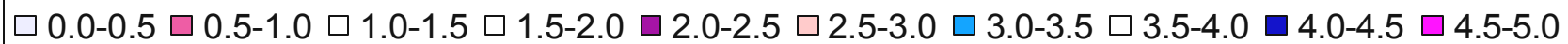
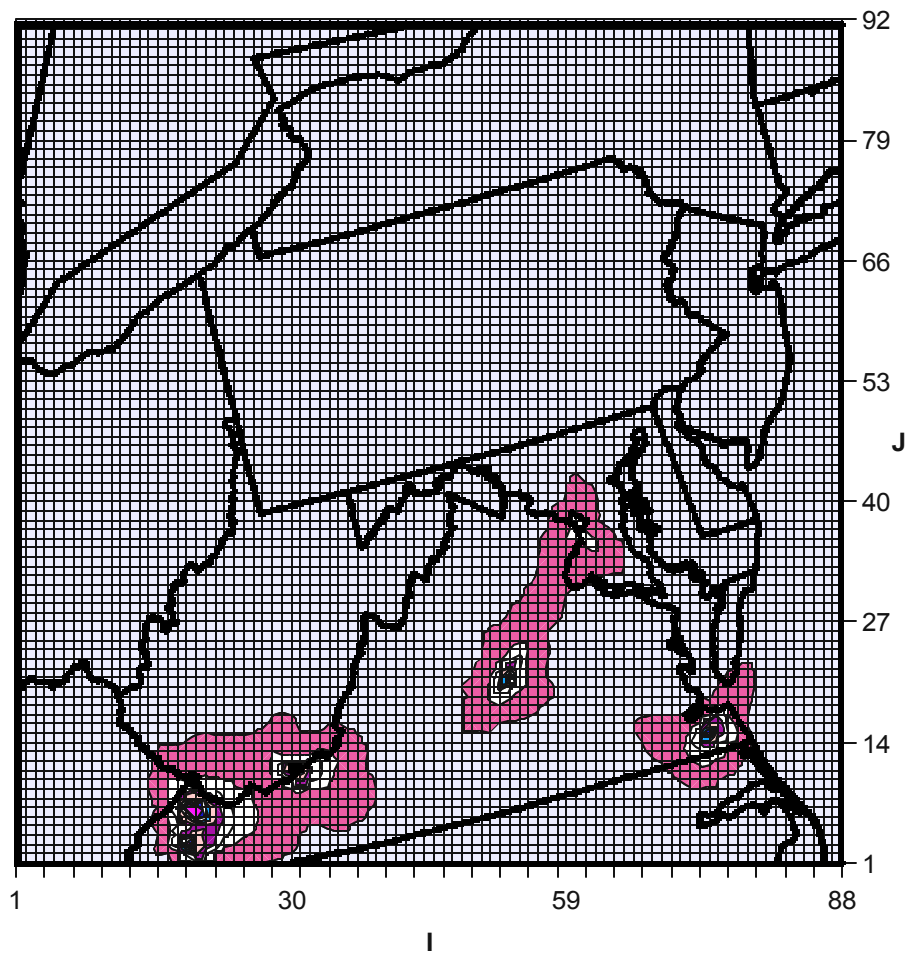


Table 2. Mercury Deposition Exceedance Area

Source	Area in which Annual Mercury Deposition Rate Was Exceeded (km ²)		
	Rate: 0.1 g/km ²	0.5 g/km ²	1.0 g/km ²
Bremo Bluff	37,260	3,480	970
Chesapeake	58,400	5,430	1,380
Clinch River	40,010	4,620	1,540
Glen Lyn	25,270	2,600	810
Jewell Coke	31,590	4,620	1,860
Potomac River	27,140	1,860	240

Table 3. Annual Deposition of Mercury to the Chesapeake Bay Watershed

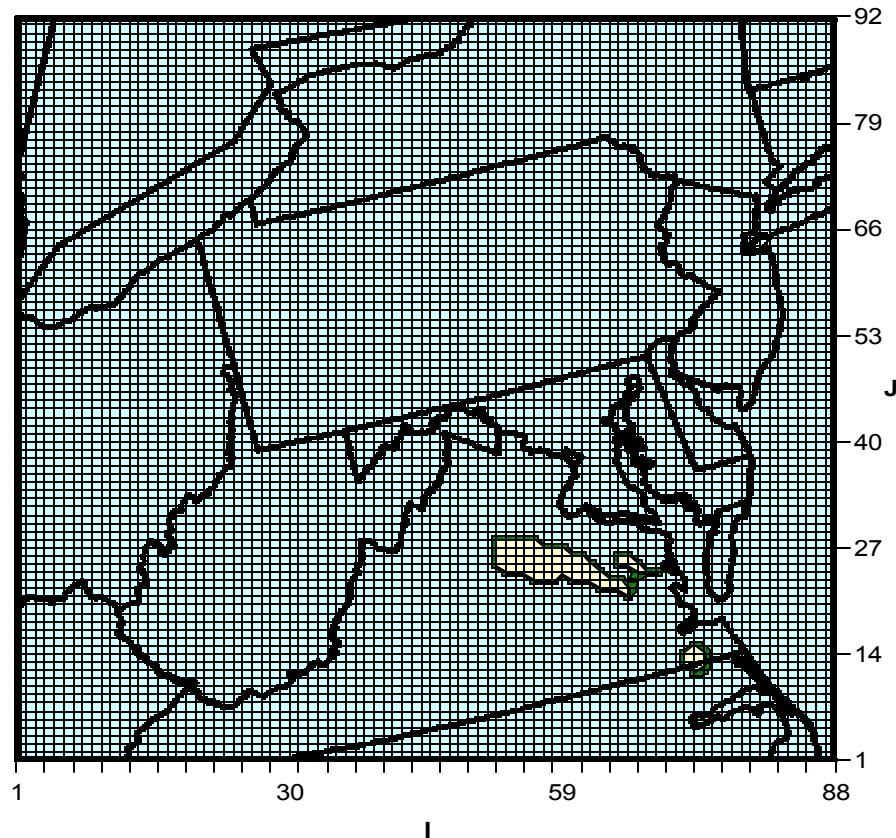
Source	Total Annual Deposition (lbs)			
	Total Mercury	Hg(0)	RGM	Hg(p)
Bremo Bluff	31.69	1.03	28.98	1.69
Chesapeake	19.50	0.27	17.67	1.56
Clinch River	7.29	0.19	6.43	0.67
Glen Lyn	9.16	0.19	8.24	0.73
Jewell Coke	5.94	1.45	1.93	2.56
Potomac River	23.24	0.38	21.31	1.54
All 6 VA sources	96.82	3.51	84.56	8.75

Table 5. Annual Deposition of Mercury within the state of Virginia

Source	Total Annual Deposition (lbs)			
	Total Mercury	Hg(0)	RGM	Hg(p)
Bremo Bluff	29.26	0.94	27.02	1.31
Chesapeake	23.01	0.31	21.13	1.58
Clinch River	25.59	0.47	23.73	1.39
Glen Lyn	15.76	0.29	14.57	0.90
Jewell Coke	19.95	6.00	9.58	4.37
Potomac River	8.45	0.16	7.75	0.54
All 6 VA sources	122.01	8.16	103.78	10.07

Sensitive Receptors; Pamunkey River Basin (PRB), Dragon Run Watershed (DRW), and Great Dismal Swamp NWR (GDS)

Sensitive Watershed Receptors



Pamunkey River Basin-Sweet Hall Marsh



Table 6. Annual Deposition of Mercury within the Pamunkey River Basin

Source	Total Annual Deposition (g)			
	Total Mercury	Hg(0)	RGM	Hg(p)
Bremo Bluff	1222	39	1144	39
Chesapeake	218	4	198	16
Clinch River	109	3	97	9
Glen Lyn	114	3	104	8
Jewell Coke	75	21	26	28
Potomac River	213	5	199	10
All 6 VA sources	1952	75	1767	110

Dragon Run



Table 7. Annual Deposition of Mercury within the Dragon Run Watershed

Source	Total Annual Deposition (g)			
	Total Mercury	Hg(0)	RGM	Hg(p)
Bremo Bluff	25.7	0.9	23.5	1.3
Chesapeake	52.5	0.7	47.7	4.0
Clinch River	5.8	0.2	5.1	0.5
Glen Lyn	5.6	0.2	5.1	0.4
Jewell Coke	4.7	1.2	1.5	1.9
Potomac River	31.0	0.6	28.9	1.6
All 6 VA sources	125.3	3.7	111.9	9.7

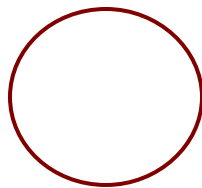
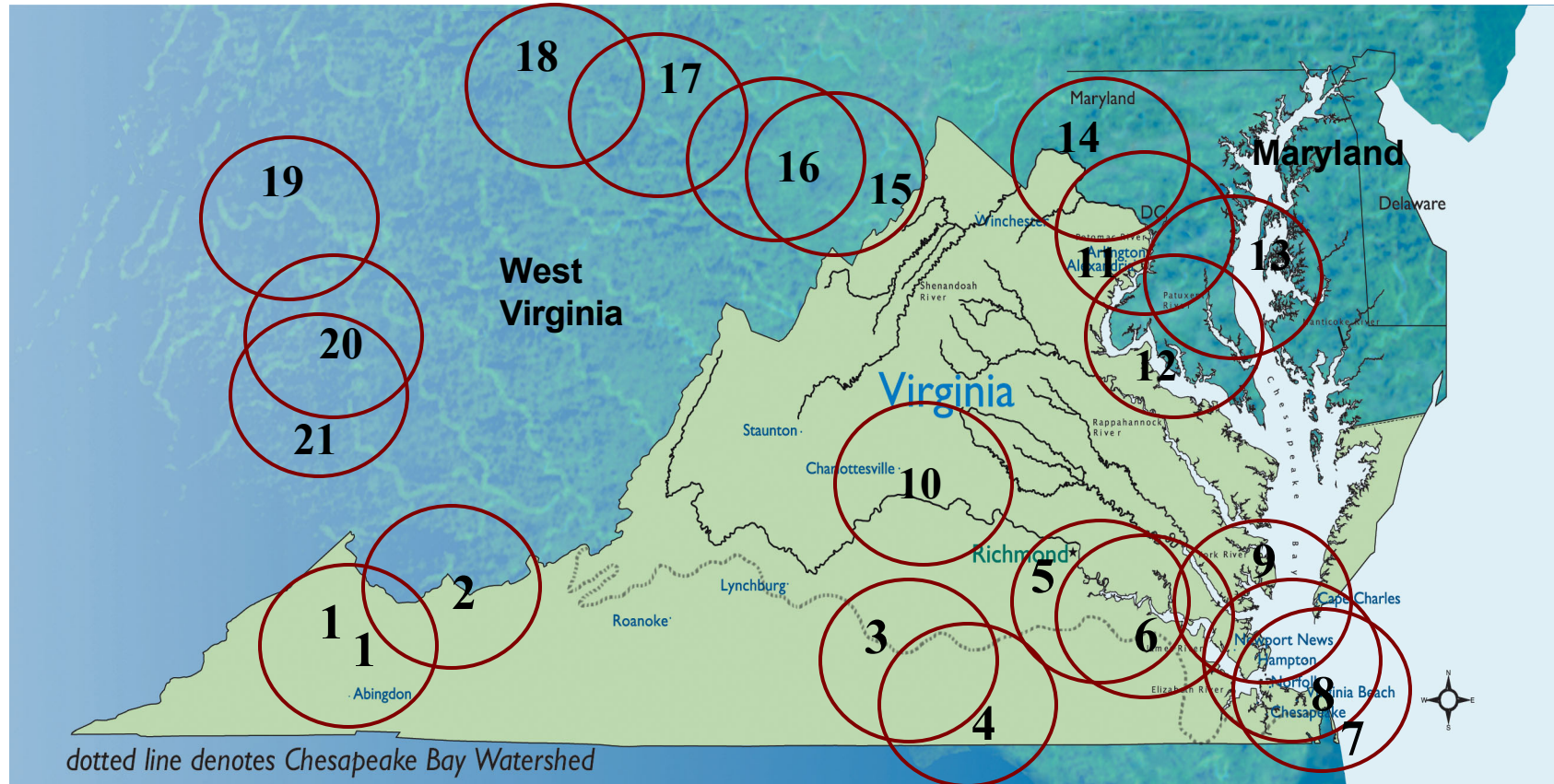
Lake Drummond, Great Dismal Swamp NWR



Table 8. Annual Deposition of Mercury within the Great Dismal Swamp NWR

Source	Total Annual Deposition (g)			
	Total Mercury	Hg(0)	RGM	Hg(p)
Bremo Bluff	13.0	0.5	11.9	0.6
Chesapeake	734.7	8.9	691.8	34.0
Clinch River	6.3	0.1	5.6	0.5
Glen Lyn	4.8	0.1	4.3	0.3
Jewell Coke	4.2	1.0	1.5	1.7
Potomac River	10.7	0.2	9.9	0.6
All 6 VA sources	773.6	10.9	725.0	37.8

Coal-Fired Power Plants within 200 miles of the Virginia Border



= one (1) coal-fired power plant and a 60 mile radius for deposition

Plant Name	Location	Size (MW)	2006 Reported Mercury/Air Release (lbs/yr)
AEP Glen Lyn (2)	Glen Lyn, VA	430	64
AEP Clinch River (1)	Cleveland, VA	700	149
Cogentrix Virginia (8)	Portsmouth, VA	120	32.8
Dominion Bremo (10)	Bremo Bluff, VA	250	154
Dominion Chesapeake (7)	Chesapeake, VA	760	150
Dominion Chesterfield (5)	Chester, VA	1726	330
Dominion Clover (3)	Clover, VA	850	19
Dominion Yorktown (9)	Yorktown, VA	1150	101
Dominion Mecklenburg Cogeneration (4)	Clarksville, VA	132	1.62
James River Cogeneration (6)	Hopewell, VA	120	31.71
Mirant Potomac River (11)	Alexandria, VA	482	35.1

Plant Name	Location	Size (MW)	2006 Reported Mercury/Air Release (lbs/yr)
Mirant Morgantown (12)	Newburg, MD	1492	380
Mirant Dickerson (14)	Dickerson, MD	853	118
Mirant Chalk Point (13)	Aquasco, MD	2369	230
AEP John Amos (21)	St. Albans, WV	2932	873
AEP Kanawha River (20)	Winfield, WV	439	84
AEP Mountaineer & Philip Sporn (19)	New Haven, WV	2405	488
AEP Kammer & Mitchell (18)	Moundsville, WV	2344	483
Dominion Mount Storm (15)	Mount Storm, WV	1632	370
Dominion North Branch (16)	Gormanian, WV	74	0.2
Dominion Morgantown Energy (17)	Morgantown, WV	65	179